Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A method of forming a contact hole with a spacer, comprising ~~the steps of~~:

(a) providing a substrate suitable for fabrication of integrated circuits and covered by at least a first dielectric layer, an etch stop layer and a patterned ~~photoresist~~ mask layer;

(b) etching the etch stop layer and the first dielectric layer using the patterned ~~photoresist~~ mask layer as a mask to form a contact hole exposing the substrate;

(c) forming a conformal second dielectric layer on the etch stop layer and in the contact hole; and

(d) anisotropically etching the second dielectric layer to form a spacer on the sidewall of the contact hole.

2. (Currently Amended) The method of claim 1, wherein the etch stop layer comprises a dielectric antireflective coating ~~layer~~.

3. (Currently Amended) The method of claim 1, wherein the conformal second dielectric layer is etched at a greater rate than the etch stop layer in ~~step~~ (d).

4. (Currently Amended) The method of claim 1, wherein the conformal second dielectric layer is etched 20 or more times as fast as the etch stop layer in ~~step~~ (d).

5. (Currently Amended) The method of claim1, wherein the etch stop layer adjacent to the contact hole is not removed in ~~step~~ (d).

6. (Currently Amended) The method of claim 2, wherein ~~step~~ (d) uses an etching gas comprising oxygen, fluorocarbon gas and carbon oxide.

7. (Currently Amended) The method of claim 6, wherein:

the first and the second dielectric layers are silicon oxide layers;

the flow rates in ~~step~~ (d) of the oxygen, fluorocarbon gas and carbon oxide are about 140 sccm, ~~-~~between about 4 and 6 sccm, and between~~-~~ about 50 and 100 sccm.

8. (Original) The method of claim 6, wherein the second dielectric layer is a tetraethylorthosilicate oxide layer.

9. (Currently Amended) The method of claim 7, wherein the ~~antireflection~~ antireflective coating ~~layer~~ is a silicon oxynitride layer.

10. (Currently Amended) The method of claim 7, wherein:

a pressure within an etch chamber is about 90 mTorr during ~~step~~ (d);

the power within an etch chamber is 200 W for a low frequency and 800 W for a high frequency during ~~step~~ (d); and

the etching gas further comprises argon with a flow rate of about 140 sccm acting as a carrier gas.

11. (Currently Amended) A method for creating contact holes having a uniform diameter from top to bottom, comprising ~~the steps of~~:

(a) forming a dielectric layer over a bottom layer;

(b) forming ~~an etch stop~~ a material layer over the dielectric layer;

(c) forming a patterned ~~photoresist~~ mask layer above the ~~etch stop~~ material layer;

(d) etching contact holes into the dielectric layer and the ~~etch stop~~ material layer using the patterned ~~photoresist~~ mask layer as a template to expose a surface of the bottom layer;

~~(e) removing the patterned photoresist layer;~~

(~~f~~e) forming a spacer ~~material~~ layer over the ~~etch stop~~ material layer and into the contact holes; and

(~~g~~f) removing the spacer ~~material~~ layer ~~from over the~~ using the material layer as an etch stop layer, wherein portions of the spacer ~~material remains~~ layer remain in the contact holes.

12. (Currently Amended) The method of claim 11, wherein the ~~etch stop~~ material layer comprises a dielectric antireflective coating ~~layer~~.

13. (Currently Amended) The method of claim 11, wherein the spacer ~~material~~ layer is etched 20 or more times as fast as the stop etch layer in ~~step~~ (gf).

14. (Currently Amended) The method of claim11, wherein the ~~etch stop~~ material layer adjacent to the contact hole is not removed in ~~step~~ (gf).

15. (Currently Amended) The method of claim 12, wherein the ~~step of~~ removing of the spacer ~~material~~ layer further comprises anisotropically etching the spacer ~~material~~ layer in an etch chamber using an etching gas comprising oxygen, fluorocarbon gas and carbon oxide.

16. (Currently Amended) The method of claim 15, wherein:

a flow rate of the fluorocarbon gas is between about 4 and 6 sccm; and

the dielectric layer and the spacer ~~material~~ layer comprise silicon oxide.

17. (Currently Amended) The method of claim 15, wherein the dielectric antireflective coating ~~layer~~ is a tetraethylorthosilicate oxide layer.

18. (Currently Amended) The method of claim 15, wherein the dielectric ~~antireflection~~ antireflective coating ~~layer~~ is a silicon oxynitride layer.

19. (Currently Amended) The method of claim 15, wherein:

a pressure within the etch chamber is about 90 mTorr during ~~step~~ (gf);

the power within the etch chamber is 200 W for a low frequency and 800 W for a high frequency during ~~step~~ (gf); and

the etching process during ~~step~~ (gf) is performed for between about 20 and 30 seconds.

20. (Currently Amended) The method of claim ~~20~~15, wherein:

the etching gas further comprises argon with a flow rate of about 140 sccm acting as a carrier gas;

the flow rate of the oxygen is about 140 sccm;

the flow rate of the carbon oxide is between about 50 and 100 sccm; and

the thickness of the antireflective coating ~~layer~~ is between about 200 and 400 angstroms.

21. (Currently Amended) A method of forming a contact hole with a spacer, comprising ~~the steps of~~:

(a) providing a substrate suitable for fabrication of integrated circuits and covered by a first dielectric layer and an etch stop layer;

(b) etching the etch stop layer and the first dielectric layer to form a contact hole exposing the substrate;

(c) forming a conformal second dielectric layer on the etch stop layer and in the contact hole; and

(d) etching the second dielectric layer to form a spacer on the sidewall of the contact hole, wherein etching of the second dielectric layer occurs at a faster rate than etching of the etch stop layer.

22. (Currently Amended) The method of claim 21, wherein the second dielectric layer is etched 20 or more times as fast as the etch stop layer in ~~step~~ (d).

23. (Currently Amended) The method of claim 21, wherein the etch stop layer adjacent to the contact hole is not removed in ~~step~~ (d).

24. (Currently Amended) The method of claim 23, wherein the etch stop layer comprises a dielectric antireflective coating ~~layer~~.

25. (New) A method of forming a contact hole with a spacer, comprising:

(a) providing a substrate covered by at least a first dielectric layer, an etch stop layer comprising a dielectric antireflective coating, and a patterned mask layer;

(b) etching the etch stop layer and the first dielectric layer using the patterned mask layer as a mask to form a contact hole exposing the substrate;

(c) forming a conformal second dielectric layer on the etch stop layer and in the contact hole; and

(d) anisotropically etching the second dielectric layer using an etching gas comprising oxygen, fluorocarbon gas and carbon oxide to form a spacer on the sidewall of the contact hole.

26. (New) The method of claim 25, wherein:

the first and the second dielectric layers are silicon oxide layers;

the flow rates in (d) of the oxygen, fluorocarbon gas and carbon oxide are about 140 sccm, between about 4 and 6 sccm, and between about 50 and 100 sccm.

27. (New) The method of claim 25, wherein the second dielectric layer is a tetraethylorthosilicate oxide layer.

28. (New) The method of claim 26, wherein the antireflective coating is a silicon oxynitride layer.

29. (New) The method of claim 26, wherein:

a pressure within an etch chamber is about 90 mTorr during (d);

the power within an etch chamber is 200 W for a low frequency and 800 W for a high frequency during (d); and

the etching gas further comprises argon with a flow rate of about 140 sccm acting as a carrier gas.

30. (New) A method for creating contact holes having a uniform diameter from top to bottom, comprising:

(a) forming a dielectric layer over a bottom layer;

(b) forming an etch stop layer comprising a dielectric antireflective coating over the dielectric layer;

(c) forming a patterned mask layer above the etch stop layer;

(d) etching contact holes into the dielectric layer and the etch stop layer using the patterned mask layer as a template to expose a surface of the bottom layer;

(e) forming a spacer layer over the etch stop layer and into the contact holes; and

(f) removing the spacer layer from over the etch stop layer, wherein the removing comprises anisotropically etching the spacer layer in an etch chamber using an etching gas comprising

oxygen, fluorocarbon gas and carbon oxide and wherein portions of the spacer layer remain in the contact holes.

31. (New) The method of claim 30, wherein:

a flow rate of the fluorocarbon gas is between about 4 and 6 sccm; and

the dielectric layer and the spacer layer comprise silicon oxide.

32. (New) The method of claim 30, wherein the dielectric antireflective coating is a tetraethylorthosilicate oxide layer.

33. (New) The method of claim 30, wherein the dielectric antireflective coating is a silicon oxynitride layer.

34. (New) The method of claim 30, wherein:

a pressure within the etch chamber is about 90 mTorr during (f);

the power within the etch chamber is 200 W for a low frequency and 800 W for a high frequency during (f); and

the etching process during (f) is performed for between about 20 and 30 seconds.

35. (New) The method of claim 30, wherein:

the etching gas further comprises argon with a flow rate of about 140 sccm acting as a carrier gas;

the flow rate of the oxygen is about 140 sccm;

the flow rate of the carbon oxide is between about 50 and 100 sccm; and

the thickness of the antireflective coating is between about 200 and 400 angstroms.